DOCUMENT RESUME

ED 390 116   EA 027 213

AUTHOR   Alspaugh, John W.
TITLE   Achievement Profiles for Elementary Schools.
PUB DATE   18 Dec 95
NOTE   20p.
PUB TYPE   Reports - Research/Technical (143)

EDRS PRICE   MF01/PC01 Plus Postage.
DESCRIPTORS   *Academic Achievement; Accountability; *Educational
                Assessment; Elementary Education; *Instructional
                Improvement; Regression (Statistics); Scores;
                *Socioeconomic Influences; *Standardized Tests; *Test
                Interpretation; Test Reliability; Test Validity
IDENTIFIERS   *Missouri Mastery and Achievement Tests

ABSTRACT
            With the growing interest in educational
accountability and outcomes-based education, there is an increasing
emphasis on testing. This paper proposes the development of
school-achievement profiles as a tool to assist with the
interpretation and implementation of test results for targeting
instructional improvement efforts. The study employed test scores
from a set of peer institutions (39 elementary schools in a
metropolitan area) as a basis for determining the relative
achievement of individual schools. Standardized residuals from a
regression analysis with socioeconomic measures as independent
variables were used to indicate the relative strengths and weaknesses
of student achievement within various grade levels and subject areas.
The profiles are designed to assist in giving direction for
allocation of instructional improvement efforts to attain a balance
in student achievement. Because of errors in measurement and
statistical procedures used to generate the residuals, it is
inappropriate to use the profiles to evaluate schools. Four tables
and two figures are included. (Contains 17 references.) (LMI)

Achievement Profiles for Elementary Schools

Submitted to

By

John W. Alspaugh
Professor of Education
Department of Educational Leadership & Policy Analysis
University of Missouri
Columbia, Missouri 65211

Phone (314) 882-9649
Fax (314) 884-5714

December 18, 1995

Abstract

With the growing interest in educational accountability and outcomes based education there is an increasing emphasis upon testing. This study proposes the development of school achievement profiles as a tool to assist with the interpretation and implementation of test results for targeting instructional improvement efforts. The test scores from a set of peer institutions are employed as a basis for determining the relative achievement of individual schools. Standardized residuals from a regression analysis with socioeconomic measures as independent variables are used to indicate the relative strengths and weaknesses of student achievement within various grade levels and subject areas. The profiles are designed to assist in giving direction for allocation of instructional improvement efforts to attain a balance in student achievement.

In recent years there has been a growing interest in accountability and testing in schools. This has lead to the development of statewide testing programs in many states. Missouri like other states has gone through a lengthy process of identifying the instructional goals for each grade level and subject area. These goals were then broken down into key skills which the students are expected to attain. The Missouri Mastery Achievement Test (MMAT) is a large battery of tests developed to measure student progress on these skills in reading, mathematics, science and social studies for grades two through ten. Only reading and mathematics are tested in the second grade. Almost all schools in the state administer the test in the spring of each year.

Issues Concerning Statewide Testing

The administration of statewide achievement tests has been received with mixed feelings on the part of many educators. There are critics who say the tests are a tool to gain control of education and the process of instruction at the state level (Airasian, 1987). With the broad scale testing we are indirectly defining the curriculum in terms of the tests which leads to a test driven curriculum (Madaus, 1988; Livingston, Castle & Nations, 1989). With measurement driven instruction there are several side effects such as standardizing the curriculum among schools. If the tests are viewed as high-stakes tests teachers tend to teach to the test (Madaus, 1989). Some educational goals are easier to test for than others. Because of ease in testing outcomes based education may shift the teaching efforts to the things that are easy to test.

Others might say the purpose of the testing it to evaluate the students, teachers and schools. If a primary goal is evaluation of teachers this tends to put undue pressure on teachers and leads to deprofessionalization of teachers (Livingston, Castle and Nations, 1989). Guskey and Kifer (1990) found that ranking the school districts of Kentucky based upon different subject area test scores leads to very inconsistent ranking of the districts. Mandeville and Anderson (1987) used multiple regression techniques to adjust test scores for the socioeconomic levels of students and used the standardized residuals as a school effectiveness index (SEI). The limited cross-subject stability and cross-year stabilty of the SEI's lead to questions concerning the value of test scores as a primary measure for evaluating schools (Mandeville, 1988). However, there is enough internal consistency of the SEI's to give some general indication of the level of relative achievement within the schools.

The original intention of the development of instructional goals and the testing effort associated with the MMAT was the improvement of instruction. Rayborn (1988) points out that the value of testing for instructional improvement depends upon how we learn to interpret and use the results of the testing effort. This research effort is concerned with the interpretation and application of the test results.

Intrepretation of test scores at the school level

After administering the tests we end up with a large set of numbers which we do not use very well. There are all of the individual student scores by subject area. Then we have average test scores by school and eventually there are state averages for each subject area and grade level. This leads to the question of how is an

effective way to organize the results of the testing effort. The testing needs to give us some meaningful direction as to where to allocate our instructional improvement efforts. There are no absolutes in educational achievement and so all of the test scores are relative. Hence the scores need to be organized to see how an individual school is achieving relative to comparable elementary schools. By forming a set of peer institutions we can see how an elementary school is achieving in relation to its peers. Within a given school there needs to be a way of making comparisons among achievement scores for the different academic areas. There is also a need for grade level to grade level comparisons.

For the purpose of this study a set of thirty nine elementary schools within a metropolitan area were considered as the set of peer institutions. The mean and standard deviation for each subject area and grade level were calculated. Then for each school the achievement scores were transformed to z-scores. The z-scores for an example school are presented in Table 1. The z-scores are an index as to how the mean school achievement scores for this school compare to the other elementary schools. A negative z-score indicates the school achievement is below the average of other schools and a positive z-score indicates the achievement is above average. The z-scores are graphed as a profile in Figure 1. The profile indicates that the example school is generally below the average of its peer institutions in achievement. The profile in Figure 1 is limited in that it does not consider the backgounds of the students the school serves. The out of school environment of the students which is reflected by their socioeconomic status is a major factor in school achievement (White, 1982; Mills, 1983).

6

If socioeconomic status of the student. is to be considered in the school profile
there is the issue of how do you measure socioeconomic status. Some of the more
often used measures consider the educational level of the parents, occupation of the
parents, family income, value and location of residence (White, 1982). The race of
students has been identified as a factor associated with achievement by several
researchers (Dummett, 1984; Matthews 1984; Reyes and Stanic, 1988; Anick
Carpenter & Smith, 1981). In an extensive review of previous research White
(1982) found that socioeconomic measures applied on an individual student basis
tend to correlate with achievement at a relatively low level. The correlations
between socioeconomic measures and achievement for aggregates of students tend
to be relatively high. This implies that if we are to adjust school profiles for
socioeconomics it would be best to do it on a school basis rather than on an
individual student basis.

The aggregate measure of socioeconomics for students in a given elementary school
can be measured by the percent of students with selected characteristics or
backgounds. The percent of students participating in free/reduced lunch programs
are indication of family income. Mandeville (1988) and Guskey and Kifer (1990)
found the percent of students receiving free or reduced lunch an effective
socioeconomic measure in the calculation of SEI's. Mobility as measured by the
percent to students entering and/or leaving school is a measure of stability of the
students' environment. The percent of students living in a two parent household is
an indicator of the students' home environment. Schools are now required to keep
records of the ethnic backgrounds of students under the five categories; White,
Black, Hispanic, Asian and Indian. Because of the current interest in the

achievement of minority students the percent of students within the ethnic groups was used in the following analysis.

Table 2 contains a comparison of the example school with its peers on measures of socioeconomic status. The socioeconomic status of the students in the example school is below the average of its peer institutions. Because of the close relationship between socioeconomic status and achievement one would anticipate that the example school would have below average achievement.

Another set of considerations for adjustment of the school profile in Figure 1 is the resources available to the school. The teaching resource could be measured by the average academic preparation and experience of the teachers. Average class sizes and available physical facilities could also be considered. The thirty nine elementary schools in the peer group are all within the same school district. The resources have been very carefully allocated so there is very little variability from school to school in terms of available resources. Hence the correlations between school resources and achievement for the set of peer schools is near zero and was not used as a factor in adjusting the school profiles.

Adjustment of Achievement Profiles

The next step was to look at the relative academic achievement within the school with the influence of socioeconomics removed. A regression line for each subject and grade level was used to calculate the expected achievement. The independent variables were percent of students on free or reduced lunch, percent of mobility, percent of students living in two parent households, percent of Hispanics, Blacks, Asians, and American Indians. Thus a set of eighteen multiple regression

equations were developed, one for each subject area and grade level. Table 3 contains the regression coefficients for third grade reading as an example. The relative contribution of each of the independent variables is indicated by the magnitude of the beta weights. The reader should note, the beta weights for percent of minority students are very small in magnitude and thus the percent of minority students has very little relationship with school achievement when considered simultaneously with the first three independent variables. This is a little inconsistent with the findings of previous research projects. This inconsistency may be due to the fact that most studies considering the achievement of minority students do not account for the socioeconomic factors that tend to be associated with minorities. By reviewing test scores of black and white students Burton and Jones (1982) found that the difference in achievement of black and white students tends to be decreasing in recent years. Lee, Aron and Aron (1988) found that the relationship between the percent of black students and achievement may be different for schools with a small percent of black students as compared to schools with a large percent of black students.

The adjusted coefficient of determination of .663 in Table 3 indicates that about two thirds of the variance in third grade reading achievement among the schools can be associated with the seven independent variables. The elementary schools are all in the same school district and have very similar instructional programs so the coefficient of determination is probably higher than would be expected for a set of schools from different school districts. Because such a large portion of the variance among the schools can be associated with the socioeconomic factors it is not appropriate to compare the school achievements without considering the socioeconomic backgrounds of the students.

The regression equations were then used to calculate the predicted or expected

achievement for each school by subject area and grade level. The standardized

residuals for each subject and grade for the example school are contained in Table

1. Standardized residuals have a mean of zero and standard deviation of one. The

standardized residuals represent the relative achievement of the school by subject

and grade after adjusting for the socioeconomic backgrounds of the students and are

comparable to the SEI's in the studies by Mandeville and Anderson (1987),

Mandeville (1988) and Guskey and Kifer (1990). Figure 2 contains a graph of the

standardized residuals. The negative z-scores graphed in Figure 1 indicate the

school is generally below average in achievement before adjustment. Most of the

standardized residuals are positive indicating that the school achievement is above

average relative to its peer institutions after adjusting for the socioeconomic

backgrounds of its students. This is a case of a school serving a low

socioeconomic group of students and at the same time attaining a higher than

expected level of achievement considering the backgrounds of the students.

By comparing the achievement profile in Figure 1 before adjustment and the profile

in Figure 2 after adjusting for the student backgrounds we can see that achievement

is a relative thing. There are clearly no absolutes in academic achievement. It is a

matter of what is the achievement level in relation to the students and resouces of

the school.

Interpreting the School Profile

A closer examination of Figure 2 will give us a picture of the balance of

achievement within the school. The pattern of the standardized residuals in Table 4

also gives us another view of the achievement pattern within the school. The

school is a little more successful in teaching reading and math than science and social studies. A grade level comparison shows that fourth grade is the weakest grade level in achievement. This gives us some direction as to where to target the instructional improvements efforts. Fourth grade is the grade of primary concern and the subjects of most concern should be science and social studies. After studying several school profiles the author found very few schools have a uniform balance in achievement from grade to grade or subject to subject. It is fairly easy to identify the strong and weak areas of a schools instructional program with an achievement profile.

The primary idea of the school achievement profile is the targeting of instructional improvement activities. By attaining a broad overall view of achievement within the school the strong and weak areas within the instructional program become apparent.

Potential Misuse of Achievement Profiles

It would be very tempting to rank the schools within the peer group based on their average standardized residual contained in the bottom right hand corner of Table 4. Because of errors in measurement and all of the statistical procedures to generate the residuals it is inappropriate to use the profiles to evaluate schools (Guskey & Kiefer, 1990). The use of these profiles to evaluate schools would lead to a test driven curriculum and the objections of many educators (Bracy, 1987; Madaus, 1988; Livingston, Castle and Nations, 1989). Because of differences of students within the school it is questionable to make grade level comparisons or comparisons of students taught by different teachers (Rayborn, 1989).

Summary

The statewide testing of students needs to be looked at carefully in terms of the overall goals of instructional improvement. Only by careful organization and interpretation of the test results will we be able to get some clear direction of where to place the instructional improvement efforts. The concept of school achievement profiles is proposed as another tool to give some direction to instructional improvement activities.

References

Airasian, P. W. (1987). State mandated testing and educational reform: Context and consequences. American Journal of Education, 95, 393-412.

Anick, C. M., Carpenter, T. P., & Smith, C (1981). Minorities and mathematics: Results from the national assessment of educational progress. Mathematics Teacher, 74, 560-566.

Bracy, G. W. (1987). Measurement-driven instruction: catchy phrase, dangerous practice, Phi Delta Kappan, 68, 683-686.

Burton, N. W., & Jones, L. V. (1982). Recent trends in achievement of black and white youth. Educational Researcher, 11, 10-14.

Dummett, L. (1984). The enigma - the persistent failure of black children in learning to read. Reading World, 24, 31-37.

Guskey, T. R. & Kifer, E. W. (1990). Ranking school districts on the basis of statewide test results: Is it meaningful or misleading? Educational Measurement Issues and Practice, 9, 11-16.

Lee, C. M., Aron, I. W. & Aron, R. H. (1983). An analysis of Michigan educational assessment program (MEAP) scores and school district revenues and expenditures. Journal of Education Finance, 13, 496-511.

Livingston, C., Castle, S. & Nations, J. (1989). Reform: One school's experience. Educational Leadership, 46, 23-25.

Madaus, G. F. (1988). The influence of testing on the curriculum. Eighty-seventh Yearbook of the National Society for the Study of Education, 83-121.

Madaus, G. F. (1989). On misuse of testing: a conversation with George Madaus. Educational Leadership, 46, 26-29.

Mandeville, G. K. (1988). School effectiveness indices revised: Cross-year stability. Journal of Educational Measurement, 25, 349-356.

Mandeville, G. K. & Anderson, L. W. (1987). The stability of school effectiveness indices across grade levels and subject areas. Journal of Educational Measurement, 24, 203-216.

Matthews, W. (1984). Influence of the learning and participation of minorities in mathematics. Journal for Research in Mathematics Education, 15, 84-95.

Mills, B. C. (1983). The effects of socioeconomic status on young children's readiness for school. Early Child Development and Care, 11, 267-274.

Rayborn, R. E. (1989). Learn what test scores really mean. American School Board Journal, 176, 34-35.

Reyes, L. H. & Stanic, G. M. A. (1988). Race, sex, socioeconomics status and mathematics. Journal for Research in Mathematics Education, 19, 26-41.

White, K. R. (1982). The relation between socioeconomic status and academic achievement. Psychological Bulletin, 91, 461-481.

Table 1. Test Scores for an Example Elemtary School

	Grade Level	School Average		Adjusted Score	
		Raw Score	z-Score	Expected	Residual
Reading	2	335	.24	289.0	1.78
	3	292	-1.31	283.6	.49
	4	289	-1.21	287.0	.11
	5	310	-.06	285.8	1.37
	6	305	-.70	292.0	.80
Math	2	331	.12	291.6	1.16
	3	301	-1.28	293.9	.30
	4	270	-1.61	278.2	-.32
	5	319	-.33	297.2	.83
	6	373	.29	325.1	2.00
Science	3	309	-1.18	300.7	.22
	4	283	-1.43	309.3	-.79
	5	332	-.12	308.6	.70
	6	370	-.16	332.4	1.24
Social Studies	3	320	-1.08	312.9	.20
	4	295	-1.44	299.6	-.23
	5	311	-.50	290.9	.86
	6	315	-.67	304.4	.42

Table 2. Socioeconomic Measures

Measure	School	District Average
% Free/Reduced Lunch	67.1	30.2
% Mobility	82.0	33.2
% Two Parent Households	49.3	67.4
% Hispancis	.0	.5
% Blacks	9.4	3.4
% Asians	.4	.7
% Indian	.8	.3

Table 3. Multiple Regression Coefficients for Third Grade Reading

Independent Variable	Correlation	b	Beta Weight
% Free/Reduced Lunch	-.818	-.857	-1.130**
% Mobiltiy	-.794	-.636	-.727*
% Two Parents	.593	-.509	-.307
% Hispanic	.014	1.632	.092
% Black	-.393	.222	.088
% Asian	.251	.767	.075
% Indian	-.309	3.139	.067

Constant = 413.425

Coefficient of Determination = .725

Coefficient of Determination adjusted for shrinkage = .663

Multiple R = .851**

Standard Error of Estimate = 17.180

* $p < .05$ ** $p < .01$

Table 4. Standardized Residuals for the Example School

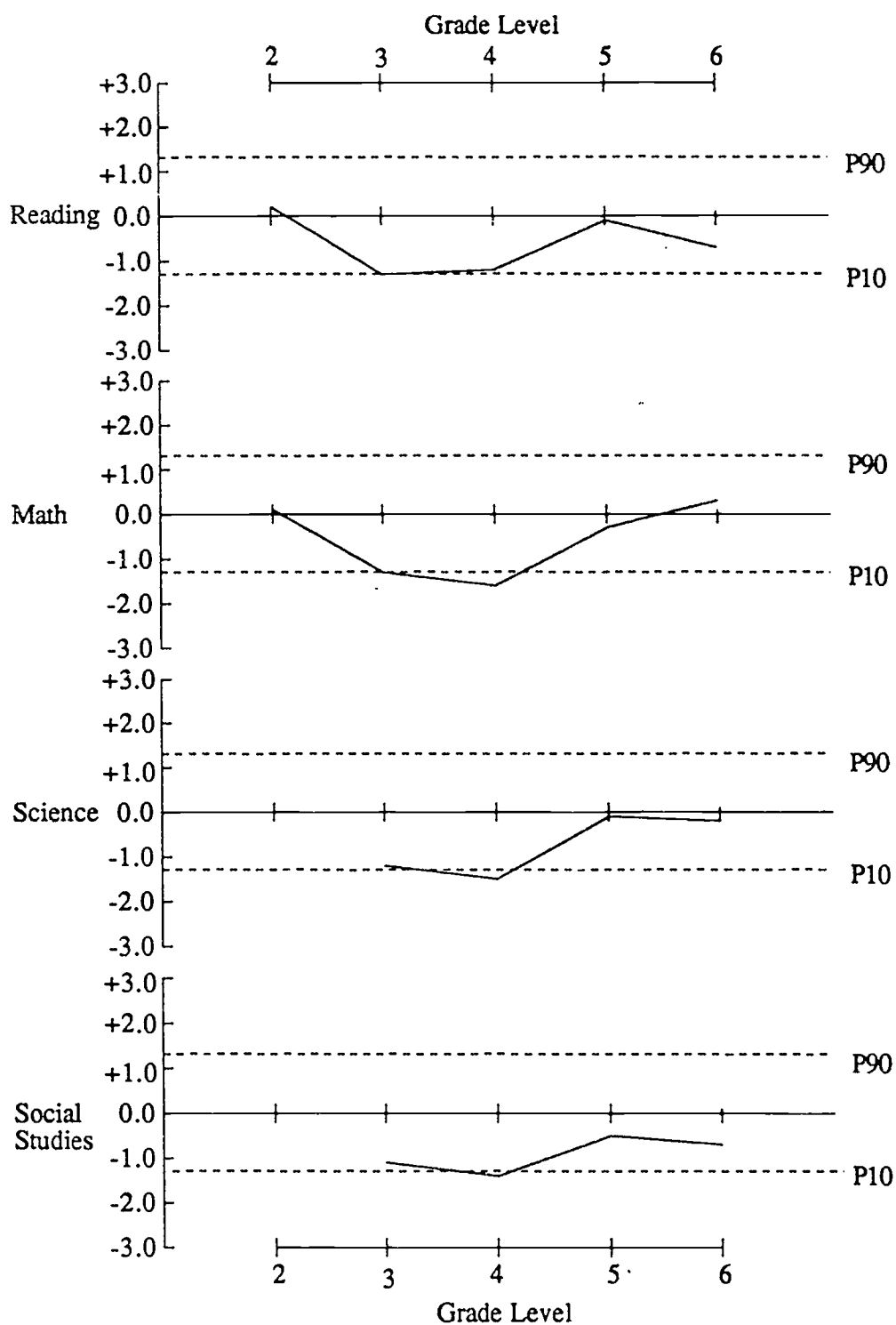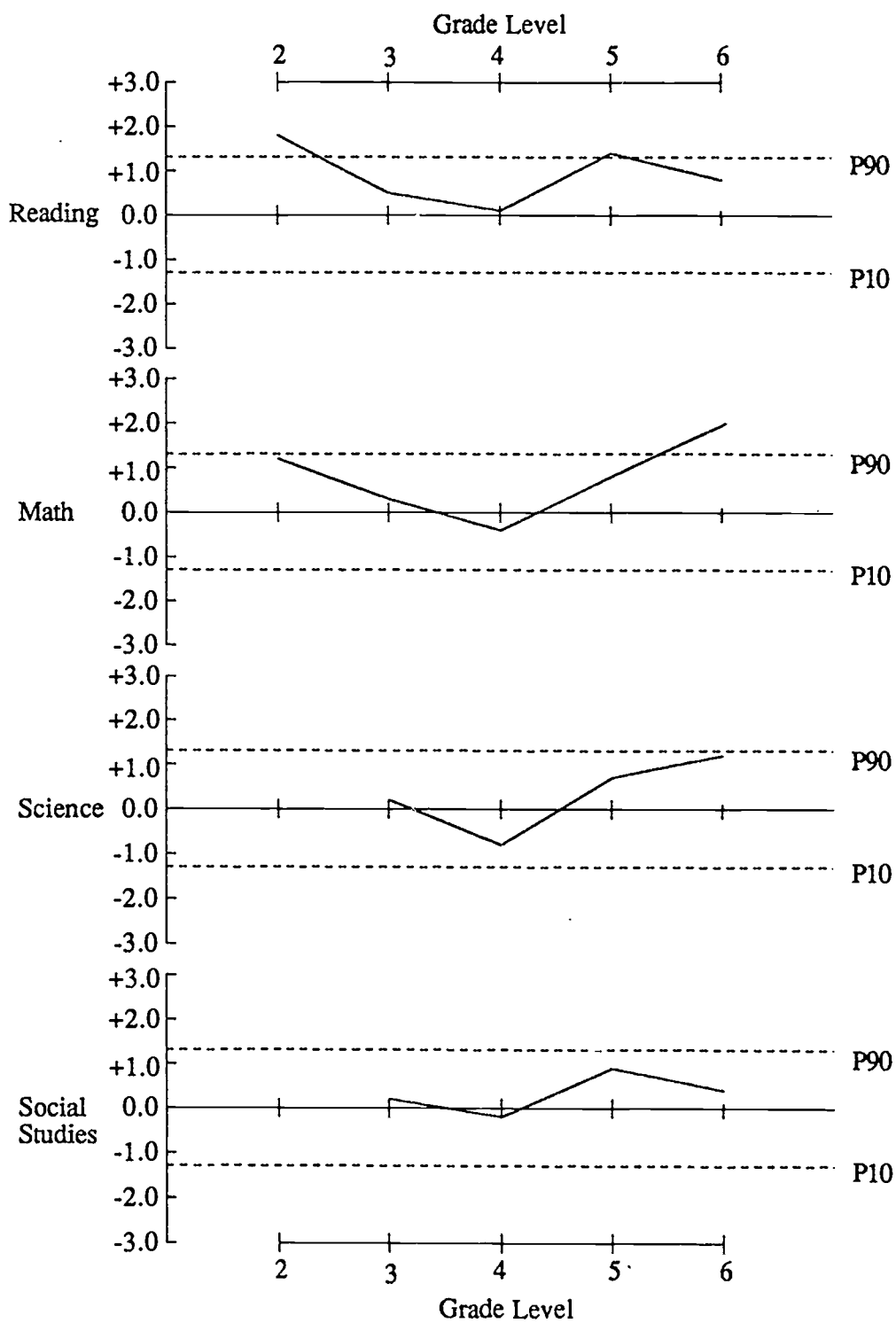| Grade	Reading	Math	Science	Social Studies	Average
2	1.78	1.61	-	-	1.70
3	.49	.30	.22	.20	.30
4	.11	-.32	-.79	-.23	-.31
5	1.37	.83	.70	.86	.94
6	.80	2.00	1.24	.42	1.12
Average	.91	.88	.34	.31	.64

Figure 1: Example School Profile Before Adjustment

Figure 2: Example School Profile After Adjustment